

REMARKS

By the present amendment and response, independent claims 1, 9, and 17 have been amended to incorporate limitations of dependent claims 4, 12, and 18, which have been canceled. Thus, claims 1-3, 5-11, 13-17, and 19-20 are pending in the present application. Reconsideration and allowance of pending claims 1-3, 5-11, 13-17, and 19-20 in view of the following remarks are requested.

The Examiner has rejected claims 1-3 and 9-11 under 35 USC §103(a) as being unpatentable over Figures 1a-3b of the present application ("Figures 1a-3b") in view of Gutsche. For the reasons discussed below, Applicant respectfully submits that the present invention, as defined by amended independent claims 1 and 9, is patentably distinguishable over Figures 1a-3b and Gutsche.

The present invention, as defined by amended independent claims 1 and 9, teaches, among other things, "an inorganic dielectric ARC layer disposed directly on the metal layer, wherein said inorganic dielectric ARC layer functions as a hard mask, and wherein said inorganic dielectric ARC layer has a substantially uniform thickness over topical non-planarities extending from the metal layer." As disclosed in the present application, the inorganic dielectric ARC layer may be applied directly over the metal layer utilizing chemical vapor deposition ("CVD") process, such as a plasma enhanced chemical vapor deposition ("PECVD") process. As a result, the present invention advantageously achieves an inorganic dielectric ARC layer that is situated directly on the metal layer and has a substantially uniform thickness over topical non-planarities that extend from the

metal layer. As disclosed in the present application, the topical non-planarities can include, for example, steps or ridges.

In contrast to the present invention as defined by amended independent claims 1 and 9, Figures 1a-3b do not teach, disclose, or suggest “an inorganic dielectric ARC layer disposed directly on the metal layer, wherein said inorganic dielectric ARC layer functions as a hard mask, and wherein said inorganic dielectric ARC layer has a substantially uniform thickness over topical non-planarities extending from the metal layer.” Figures 1a-3b disclose metal stack 302 comprising metal layer 314, organic ARC layer 312 and barrier layer 316. After a metal etching process, microelectronic structures 320, 322, and 324 are formed on metal layer 314. However, organic ARC layer 312 comprises organic material and is, therefore, not an inorganic dielectric ARC layer as specified in amended independent claims 1 and 9. Furthermore, Figures 1a-3b fail to teach, disclose, or suggest an inorganic dielectric ARC layer disposed directly on a metal layer, where the inorganic dielectric ARC layer has a substantially uniform thickness over topical non-planarities that extend from the metal layer.

In contrast to the present invention as defined by amended independent claims 1 and 9, Gutsche does not teach, disclose, or suggest “an inorganic dielectric ARC layer disposed directly on the metal layer ... wherein said inorganic dielectric ARC layer has a substantially uniform thickness over topical non-planarities extending from the metal layer.” Gutsche specifically discloses hard mask 510 situated over barrier/ARC layer 508, which is situated over metal layer 506. See, for example, column 5, lines 24-39 and

Figure 5 of Gutsche. However, Gutsche fails to teach, disclose, or suggest an inorganic dielectric ARC layer disposed directly on a metal layer, where the inorganic dielectric ARC layer has a substantially uniform thickness over topical non-planarities that extend from the metal layer.

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claims 1 and 9, is not suggested, disclosed, or taught by Figures 1a-3b and Gutsche, either singly or in combination thereof. As such, the present invention, as defined by amended independent claims 1 and 9, is patentably distinguishable over Figures 1a-3b and Gutsche. Thus claims 2 and 3 depending from amended independent claim 1 and claims 10 and 11 depending from amended independent claim 9 are, *a fortiori*, also patentably distinguishable over Figures 1a-3b and Gutsche for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The Examiner has further rejected claims 7-8 and 17-20 under 35 USC §103(a) as being unpatentable over Figures 1a-3b and Gutsche as applied to claims 1-3 and 9-11, and further in view of U.S. patent number 6,121,133 to Iyer et al. ("Iyer"). For the reasons discussed below, Applicant respectfully submits that the present invention, as defined by amended independent claim 17, is patentably distinguishable over Figures 1a-3b, Gutsche, and Iyer, either singly or in combination thereof.

The present invention, as defined by amended independent claim 17, teaches, among other things, at least one microelectronic structure extending from an oxide layer

and including an inorganic dielectric ARC layer disposed directly on a metal layer and “a residual photoresist layer disposed directly on said inorganic dielectric ARC layer.” As disclosed in the present application, a residual photoresist layer can remain on the inorganic dielectric ARC layer of a microelectronic structure after completion of a metal etching step. The combination of the residual photoresist layer and the inorganic dielectric ARC layer, which is disposed directly on the inorganic ARC layer, is utilized by the present invention to advantageously preserve the structural integrity of the top portion of the microelectronic structure.

In contrast to the present invention as defined by amended independent claim 17, Figures 1a-3b do not teach, disclose, or suggest at least one microelectronic structure extending from an oxide layer and including an inorganic dielectric ARC layer disposed directly on a metal layer and “a residual photoresist layer disposed directly on said inorganic dielectric ARC layer.” Figures 1a-3b specifically disclose microelectronic structures 320, 322, and 324, which are formed on metal layer 314 after a metal etching process. However, Figures 1a-3b do not teach, disclose, or suggest a microelectronic structure including an inorganic dielectric ARC layer disposed directly on a metal layer and a residual photoresist layer disposed directly on the inorganic dielectric ARC layer.

In contrast to the present invention as defined by amended independent claim 17, Gutsche does not teach, disclose, or suggest at least one microelectronic structure extending from an oxide layer and including an inorganic dielectric ARC layer disposed directly on a metal layer and “a residual photoresist layer disposed directly on said

inorganic dielectric ARC layer.” Gutsche specifically discloses hard mask 512 situated on metal feature 516 after performance of a metallization etching process. See, for example, column 6, lines 19-21 and Figure 8 of Gutsche. However, Gutsche fails to teach, disclose, or suggest a microelectronic structure including a residual photoresist layer disposed directly on an inorganic dielectric ARC layer.

In contrast to the present invention as defined by amended independent claim 17, Iyer does not teach, disclose, or suggest at least one microelectronic structure extending from an oxide layer and including an inorganic dielectric ARC layer disposed directly on a metal layer and “a residual photoresist layer disposed directly on said inorganic dielectric ARC layer.” Iyer specifically discloses an oxidation diffusion barrier stack situated on silicon wafer 200, where the oxidation diffusion barrier stack includes pad oxide layer 202, first silicon nitride layer 226, inorganic ARC layer 206, second silicon nitride layer 210, and photoresist layer 214. See, for example, column 8, lines 13-59 and Figure 2E of Iyer. However, in Iyer, the oxidation diffusion barrier stack does not include a metal layer or a hard mask. Furthermore, Iyer does not teach, disclose, or suggest a microelectronic structure including a residual photoresist layer disposed directly on an inorganic dielectric ARC layer.

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claim 17, is not suggested, disclosed, or taught by Figures 1a-3b, Gutsche, and Iyer, either singly or in combination thereof. As such, the present invention, as defined by amended independent claim 17, is patentably

distinguishable over Figures 1a-3b, Gutsche, and Iyer. Thus claims 19 and 20 depending from amended independent claim 17 are, *a fortiori*, also patentably distinguishable over Figures 1a-3b, Gutsche, and Iyer for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The Examiner has further rejected claims 4-6 and 13-14 under 35 USC §103(a) as being unpatentable over Figures 1a-3b and Gutsche as applied to claims 1-3 and 9-11, and further in view of U.S. patent number 6,200,909 to Torek et al. ("Torek"). For the reasons discussed below, Applicant respectfully submits that the present invention, as defined by amended independent claims 1 and 9, is patentably distinguishable over Figures 1a-3b, Gutsche, and Torek, either singly or in combination thereof.

As discussed above, the present invention, as defined by amended independent claims 1 and 9, is patentably distinguishable over Figures 1a-3b and Gutsche. Also, in contrast to the present invention, as defined by amended independent claims 1 and 9, Torek does not teach, disclose, or suggest "an inorganic dielectric ARC layer disposed directly on the metal layer, wherein said inorganic dielectric ARC layer functions as a hard mask, and wherein said inorganic dielectric ARC layer has a substantially uniform thickness over topical non-planarities extending from the metal layer." Torek specifically discloses Darc layer 24 situated over oxide layer 20. See, for example, column 3, lines 12-13 and Figure 3 of Torek. However, Torek fails to teach, disclose, or suggest an inorganic-dielectric ARC layer, which functions as a hard mask, disposed directly on a metal layer. Consequently, Torek also fails to teach, disclose, or suggest an inorganic


dielectric ARC layer disposed directly on a metal layer, where the inorganic dielectric ARC layer has a substantially uniform thickness over topical non-planarities that extend from the metal layer.

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claims 1 and 9, is not suggested, disclosed, or taught by Figures 1a-3b, Gutsche, and Torek, either singly or in combination thereof. As such, the present invention, as defined by amended independent claims 1 and 9, is patentably distinguishable over Figures 1a-3b, Gutsche, and Torek. Thus claims 5 and 6 depending from amended independent claim 1 and claims 13 and 14 depending from amended independent claim 9 are, *a fortiori*, also patentably distinguishable over Figures 1a-3b, Gutsche, and Torek for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The Examiner has further rejected claims 15-16 under 35 USC §103(a) as being unpatentable over Figures 1a-3b and Gutsche as applied to claims 1-3 and 9-11, and further in view of U.S. patent number 6,166,427 to Huang et al. As discussed above, amended independent claim 9 is patentably distinguishable over Figures 1a-3b and Gutsche. Thus claims 15-16 depending from amended independent claim 9 are also patentably distinguishable over Figures 1a-3b and Gutsche.

Based on the foregoing reasons, the present invention, as defined by amended independent claims 1, 9, and 17 and claims depending therefrom, is patentably distinguishable over the art cited by the Examiner. Thus, claims 1-3, 5-11, 13-17, and 19-20 pending in the present application are patentably distinguishable over the art cited by the Examiner. As such, and for all the foregoing reasons, an early allowance of claims 1-3, 5-11, 13-17, and 19-20 pending in the present application is respectfully requested.

Respectfully Submitted,
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claim 1 has been amended as follows:

1. (Twice Amended) A semiconductor workpiece, comprising:
a metal layer;
an inorganic dielectric ARC layer disposed directly on the metal layer, wherein
said inorganic dielectric ARC layer functions as a hard mask, and wherein said inorganic
dielectric ARC layer has a substantially uniform thickness over topical non-planarities
extending from the metal layer; and
a photoresist layer disposed on the ARC layer opposite the metal layer.

Claim 4 has been canceled.

Claim 9 has been amended as follows:

9. (Twice Amended) A metallic stack for a semiconductor interconnect,
comprising:
a metal layer;
an inorganic dielectric ARC layer disposed directly on the metal layer, wherein
said inorganic dielectric ARC layer functions as a hard mask, and wherein said inorganic

dielectric ARC layer has a substantially uniform thickness over topical non-planarities extending from the metal layer; and

a barrier layer disposed on the metal layer opposite the ARC layer.

Claim 12 has been canceled.

Claim 17 has been amended as follows:

17. (Once Amended) A semiconductor device, comprising:

an oxide layer formed on a wafer; and

at least one microelectronic structure extending from the oxide layer and including:

a barrier layer disposed on the oxide layer;

a metal layer disposed on the barrier layer; [and]

an inorganic dielectric ARC layer disposed directly on the metal layer, wherein said inorganic dielectric ARC layer functions as a hard mask; and

a residual photoresist layer disposed directly on said inorganic dielectric ARC layer.

Claim 18 has been canceled.